Interim Action Basis of Design for LNAPL Barrier System

Former BNSF Fueling and Maintenance Facility
Skykomish, Washington

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ThermoRetec Project Number: BN050-04018-460

Prepared for:

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1 Introduction

This report presents the basis of design for an interim action to be completed at the Burlington Northern and Santa Fe Railway Company's (BNSF's) former fueling and maintenance facility in Skykomish, Washington. This interim action will consist of a barrier wall and light non-aqueous phase liquids (LNAPL) recovery system to eliminate seeps of this material to the South Fork of the Skykomish River. This interim action will be implemented by BNSF pursuant to an Agreed Order with the Department of Ecology (Ecology) following public review and comment.

The purpose of this report is to provide the conceptual design for the interim action and the performance criteria that will guide the implementation and future operations and maintenance. This report is also intended to provide sufficient information regarding the proposed interim action to allow for public comment and input on the proposed interim action relatively early in the implementation process. Background information regarding the site, its physical location and geology/hydrogeology is presented below, followed by a description of the interim action. This section concludes with the organization for the remainder of this report.

1.1 Background

The site was historically used to refuel and maintain locomotives, provide electricity for electric engines, store snow removal equipment, and as a base of operations for local track repair and maintenance. Currently the site is limited to the latter two activities and is owned and operated by BNSF. A detailed operational history of the railyard is provided in the draft Remedial Investigation (RI) report (RETEC, 1996) and the draft Feasibility Study (FS)(ThermoRetec, 1999).

In 1993, BNSF entered into an Agreed Order (No. DE91TC-N213) with the Washington Department of Ecology (Ecology) to conduct a Remedial Investigation and Feasibility Study (RI/FS) and to implement certain interim actions. The order was prompted by oily seeps to the South Fork of the Skykomish River and the enactment of MTCA. The oil was first investigated during various phases of exploration performed from 1973 to 1992. The RI field work was completed in 1993 and 1994 and is documented in the RI report (RETEC, 1996). The draft RI report documents results of the field investigation, laboratory analytical testing, and conclusions developed under the RI. A draft Feasibility Study (FS) was submitted to Ecology in 1999 and is currently being reviewed. The FS identifies the alternatives available for cleanup of contaminated soil and groundwater at the site and provides a description of the proposed cleanup actions. Neither the draft RI nor the draft FS reports have gone through a 30-day public comment period. In February 2001, Ecology asked BNSF to perform an interim action to reduce and eventually eliminate petroleum seeps to the river during 2001. In response to

this request, BNSF proposed the interim action described herein. This interim action is part of the overall remedy proposed by BNSF in the FS.

1.2 Site Description

The site is located in the Town of Skykomish, King County, Washington, and includes BNSF property and surrounding areas impacted by activities performed at the former fueling and maintenance facility. The general site layout and BNSF property boundary are shown on Figure 1-1. Railroad Avenue separates the railroad property from the main commercial district of the town. Maloney Creek flows east of the site and a former channel of Maloney Creek lies in the southern portion of the BNSF property. Maloney Creek flows to the South Fork of the Skykomish River. The site encompasses an area of approximately 40 acres.

Previous site investigations have identified an LNAPL plume, which extends from the railyard downgradient of the facility. The approximate area of the LNAPL plume is shown on Figure 1-2. The LNAPL from the railyard is a mix of diesel and Bunker C fuel oil. LNAPL samples from the Skykomish site were tested and found to be lighter than water and highly viscous. Field monitoring data indicate the extent of the plume has remained stable since 1993, although our interpretation of the exact location, shape, distribution and product thicknesses in the interior of the plume has varied somewhat over time. Since 1995, recovery wells installed downgradient of the facility have been operated to recover product. Floating oil-absorbent booms are used seasonally to intercept and contain seeps occurring at the riverbank. The recovery wells and oil booms were implemented as interim actions under the 1993 Agreed Order.

1.3 Site Hydrogeology and Aquifer Properties

The site is located within the Skykomish River valley. The glaciofluvial sediments filling the valley consist mainly of poorly- to moderately-sorted sand, gravel, and cobbles. The base of the sediments is estimated to be located 200 to 250 feet below ground surface (bgs). Previous field investigations showed that the site is generally underlain by sand and gravel, with silt and clay lenses.

The aquifer at the site is unconfined and has been investigated to a depth of 47 feet bgs. The upper 10 to 15 feet of the aquifer consist predominantly of gravelly sand to sandy gravel, which locally contains a trace to some silt. Large cobbles and gravels are present throughout. The hydraulic conductivities of aquifer materials at the site were determined via slug tests to be between 0.4 feet per day (1.42×10^{-4} cm/s) and 79 feet per day (2.79×10^{-2} cm/s) during the RI. An average hydraulic conductivity of 50 feet per day has

been used in previous fate and transport modeling and in the modeling work presented in Appendix A.

Groundwater occurs at a shallow depth beneath the site (generally 5 to 15 feet bgs). Groundwater elevations are the highest at the southeast corner of the site and decrease northwestward toward the Skykomish River, indicating groundwater flow is generally from the southeast to the northwest. Gauging data indicate the seasonal variation in groundwater elevation can range from about 4 to 7 feet. Groundwater elevations are generally higher during late fall, winter, and spring (November to April) and lower in the summer and early fall (June to early November). Figure 1-3 is a potentiometric surface map showing groundwater elevations in April 1998; Figure 1-4 shows groundwater elevations in September 1998. These figures are representative of typical high and low groundwater elevations, respectively, at the site.

1.4 Interim Action Scope

The preliminary scope of the interim action is documented in the *Estimated Scope of Interim Actions Planned for 2001* ThermoRetec letter dated February 26, 2001, and was further developed during subsequent meetings and correspondence with Ecology. The interim action scope of work includes installation of a barrier system to reduce and eventually eliminate petroleum seeps to the River. BNSF believes that a barrier wall with upgradient petroleum recovery provides the best opportunity to eliminate product seeps to the River.

The barrier system will be installed in a phased approach. Phase 1 will entail installation of a barrier wall, monitoring wells and recovery wells. The barrier wall will be installed along West River Road, adjacent to the flood control levee. The monitoring and recovery wells will be installed upgradient and at the ends of the wall to supplement the existing monitoring and recovery well network. Initial monitoring of LNAPL accumulation and equilibration will be performed after the wall is constructed. Figure 1-5 provides a schematic cross-section view of the wall, mounded LNAPL behind the wall, groundwater flow beneath the wall, and an example of an LNAPL recovery well.

All of the new monitoring wells would be sized and constructed in a manner to accommodate installation of belt skimmer product recovery systems that will be installed during Phase 2. Phase 2 will begin 6 to 12 months after the wall is installed. Phase 2 will also include installation of piping from recovery wells to a product storage area(s) and electrical hook-up. This phased approach eliminates the potential to connect "non-producing" wells to the recovery system.[1] The existing product recovery system will continue to

[1] Operation of the current product recovery system has shown that although LNAPL may be present during well installation that is not a reliable indication of continued recharge of LNAPL to the well.

operate upgradient of the barrier wall if it is able to be preserved during construction of the barrier wall. Depending on the extent of product accumulation in the new recovery wells prior to installation during Phase 2, periodic pumping of product will be performed as necessary and to determine the rate of recharge.

Fluid level gauging will be performed to provide information on the response of LNAPL plume distribution, thickness and potentiometric surface to installation of the barrier wall. These data will be used in design of the Phase 2 recovery system. Site wide groundwater sampling for dissolved total petroleum hydrocarbons (TPH) will also be performed periodically at the site.

1.5 Report Organization

Section 2 of this report presents the Phase 1 barrier wall and well design criteria and approach. The Phase 2 recovery system description and work to be done are presented in Section 3. Section 4 of this report presents the performance specifications for construction of Phase 1 of the interim action. Section 5 outlines the barrier monitoring plan and Section 6 describes the remaining tasks and schedule for completing the design and construction of Phase 1. References used in preparing this report are listed in Section 7. Appendices to this report include:

Appendix A – Groundwater Modeling Technical Memorandum

Appendix B – Hydrographs for Existing Wells along Proposed Barrier Wall Alignment

Appendix C – 2001 Topographical Survey of Proposed Barrier Wall Corridor and Vicinity

Appendix D – Flood Control Levee Details prepared by U.S. Army Corps of Engineers

Appendix E – Description of Grout Curtain Technology

Appendix F – SEPA Checklist

The barrier wall is intended to physically contain product, thereby enhancing its recoverability and minimizing the potential for non-producing wells.